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Letter

Modeling Inequity Aversion in a Dictator Game with Production

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Abstract: We expand upon the previous models of inequity aversion of Fehr and Schmidt [1], and Frohlich *et al.* [2], which assume that dictators get disutility if the final allocation of surplus deviates from the equal split (egalitarian principle) or from the subjects' production (libertarian principle). In our model, dictators may also account for the way in which the surplus was generated. More precisely, our model incorporates the idea of liberal egalitarian ethics into the analysis, making it possible for dictators to divide the surplus according to the accountability principle, which states that subjects should only be rewarded for factors under their control. This fairness ideal does not hold subjects responsible for factors beyond their control in the production of the surplus, an idea that is absent in the models of inequity aversion cited above (JEL Codes: D3, D6, D63).

Keywords: social preferences; inequity aversion; inequality aversion; egalitarian principle; libertarian principle; accountability principle

1. Introduction

The standard assumption that subjects only care about their own material payoff is frequently used to solve economic models. However, the overwhelming experimental evidence against this assumption (especially in the dictator experiment) indicates that subjects are willing to sacrifice their own material payoff so as to achieve fair allocations (see Camerer [3] and Engel [4]).

In the field of experimental economics, the dictator game with production (e.g., Cappelen *et al.* [5], Cherry *et al.* [6] and Konow [7]) has recently emerged as a useful tool to investigate fairness attitudes towards redistribution. In this game, subjects contribute to the production of surplus before a randomly selected dictator chooses a division of this surplus.[1] The findings of the literature highlight that dictators are willing to reward other subjects' efforts, even though this behavior contradicts the selfish hypothesis (Frohlich *et al.* [2], Oxoby and Spraggon [8], Ruffle [9]). It is also found that subjects exhibit heterogeneous preferences with regard to the distribution of the surplus (Cappelen *et al.* [5], Konow [7], Miller and Ubeda [10], Rodriguez-Lara and Moreno-Garrido [11]), suggesting the existence of different fairness ideals.

Although the importance of the production stage has been crucial to achieve these results, almost no studies of social preferences incorporate the source of the surplus into the theoretical analysis. The models of social preferences that have been put forward to explain dictators' deviations from narrow self-interest usually focus on the way in which dictators divide the surplus, while leaving aside the way in which the surplus was generated (see Fehr and Schmidt [12] for an overview of the theoretical literature). One exception is Frohlich *et al.* [2] who generalize the model of inequality aversion of Fehr and Schmidt [1]. In their model, Frohlich *et al.* [2] consider that dictators' behavior depends on two different costs. On the one hand, dictators' utility decreases if subjects do not receive exactly the same monetary payoff, as in Fehr and Schmidt [1]. On the other hand, there exists a cost for dictators if the final allocation deviates from the subjects' production. By assessing both types of costs, the model of Frohlich *et al.* [2] allows dictators to choose the egalitarian allocation (which divides the surplus in two identical parts) and the libertarian allocation (which assumes that subjects ought to receive exactly the value of their production).[2] Arguably, some factors that determine the subjects' production might be beyond their control, not withstanding that the libertarian allocation holds subjects responsible for all factors determining production.

In this paper, we propose a simple extension of Fehr and Schmidt [1] and Frohlich *et al.* [2] so as to account for the possibility of dictators dividing the surplus according to the accountability principle. The accountability principle, as first proposed by Konow [13], combines both equity theory (which

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[1] Hereafter we focus our exposition on the dictator game with production, which has been an important device for studying social preferences and distributional justice. We note that the existence of the production stage is important to disentangle the effect of fairness concerns and property rights in the final outcome. As noted by Cherry *et al.* [6], if there is not a production stage, then dictators might give money away, because they are fair-minded, or simply because the surplus to be divided is "manna from heaven", and dictators do not feel any right to keep the entire surplus for themselves.

[2] Frohlich *et al.* [2] use the concept of "just desert" to identify the division of the surplus that corresponds to the subjects' production. We borrow the terminology in Cappelen *et al.* [5,14] and refer to this division as the libertarian allocation. Hereafter, we follow Cappelen *et al.* [5,14] in labeling the rest of the fairness ideals presented in the paper.

makes the final allocation proportional to the agents' inputs) and attribution theory (which considers responsibility or control over inputs). This fairness ideal is related to liberal egalitarian ethics (which assumes that subjects should only be rewarded for factors under their control). There exists overwhelming evidence showing that subjects employ to some extent the accountability principle (see Cappelen *et al.* [5,14,15], Konow [7], Konow [16], Rodriguez-Lara and Moreno-Garrido [11]). We lack, however, theoretical models that predict this allocation. We posit a utility function in which dictators juggle the tradeoff between subjects' inputs and monetary contributions, so that dictators weigh three different fairness ideals: the egalitarian principle, the libertarian principle and the accountability principle. The latter fairness ideal is disregarded in Fehr and Schmidt [1] and Frohlich *et al.* [2], but it is relevant whenever subjects' inputs are differently rewarded to determine the size of the surplus, *i.e.*, when there are factors outside the subjects' control (Cappelen *et al.* [5,14], Konow [7], Rodriguez-Lara and Moreno-Garrido [11]). In this framework, it is plausible to assume that dictators do not only care about the final distribution of payoffs, but also about the way in which entitlements were generated. In particular, our model allows for dictators to evaluate the role of compensation and responsibility, two features that constitute the gist of fairness (see among others Cappelen *et al.* [17], Fleurbaey and Maniquet [18], Rawls [19] and Roemer [20]).

To the best of our knowledge, there are only two theoretical models that consider the possibility of dictators choosing the accountability principle (Cappelen *et al.* [5] and Konow [7]). Despite some differences in their functional form, the models assume that dictators endorse a fairness ideal (e.g., the accountability principle) and suffer a cost if they deviate from it. Our approach does also account for this possibility, but generalizes the framework by allowing heterogeneity in fairness preferences to take place within subjects. In that vein, we do not need to consider that dictators are motivated by a single fairness ideal, with dictators being heterogeneous in what they consider as fair. It is also plausible to assume that fairness ideals are tradeoffs against each other, and heterogeneity lies inside each individual (*i.e.*, our model could be used to investigate whether fairness principles are context-dependent, to study the consistency of fairness rules or to analyze the possibility of self-serving bias).[3]

The rest of the paper is organized as follows. Section 2 briefly describes the models of Fehr and Schmidt [1] and Frohlich *et al.* [2] and then presents our theoretical model. In Section 3, we discuss our findings and use a couple of examples so as to clarify when our model does yield different predictions than previous models of inequity aversion in the literature. We conclude in Section 4.

2. Results and Discussion

Consider the dictator game in which subjects can be labeled i∈{d,r}, where d represents the dictator and r represents the recipient. The dictator has to divide a certain surplus $\bar{y} \geq 0$ between herself and her

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[3] The approach in Cappelen *et al.* [5,14] relies on the assumption of between-subject heterogeneity; *i.e.*, subjects differ with respect to their consideration of fairness ideals (see also Engel [4] or Visser [21] for evidence of between-subject heterogeneity). However, there exists experimental evidence suggesting the existence of within-subject heterogeneity; *i.e.*, the same subject might choose different allocations (or fairness ideals) depending on the context (see, among others, in Croson and Konow [22], Konow [16], Messick and Sentis [23], Miller and Ubeda [10], Ubeda [24] or Yaari [25]).

counterpart. The size of this surplus depends on both the subjects' monetary contributions, which are denoted by $y_i \geq 0$ for $i \in \{d,r\}$, in particular,

$$\overline{y} = y_d + y_r = p_d q_d + p_r q_r \tag{1}$$

where $q_i \geq 0$ represents subject i's performance in a (previous) production stage, and $p_i > 0$ is the weight assigned to this input, for $i \in \{d,r\}$. In what follows, we shall think that $q_i \geq 0$ is under the subject i's control (e.g., exerted effort, time of work, money to be invested in a project, *etc.*). The value of $p_i > 0$ is assumed to be independent of $q_i \geq 0$ and determines the way in which agent i's input is transformed into money. We shall think that $p_i > 0$ is outside the subject i's control (e.g., reward level, rate of return, luck, *etc.*).[4]

The dictator has to choose a division of the surplus $\mathbf{x} = (x_d, x_r)$ that satisfies $x_d + x_r = \overline{y}$, where $x_i \geq 0$ denotes the monetary payoff that subject i will receive, for $i \in \{d,r\}$. The model of inequality aversion of Fehr and Schmidt [1] builds on the assumption that the dictator dislikes unequal outcomes (see Nielsen [26]). More specifically, the authors posit the following utility function for the dictator:

$$u(x_d) = x_d - \alpha \max \{x_r - x_d, 0\} - \beta \max \{x_d - x_r, 0\} \tag{2}$$

This function accounts for social preferences because the dictator does not only care about her own monetary payoff. The dictator's utility also depends on the recipient's payoffs and the relationship between both subjects' payoffs. In particular, the model of Fehr and Schmidt [1] assumes that it would be costly for the dictator to take more than half of the surplus, but it would also be costly for her to take less. The magnitude of the costs is given by the values of α and β, which are assumed to satisfy $\alpha > \beta \geq 0$ and $\beta \leq 1$. This implies that the dictator cares more for inequality when she has less than half of the surplus than the dictator does when she has more.

As $x_r = \overline{y} - x_d$, equation (2) can be rewritten as follows:

$$u(x_d) = x_d - 2\alpha \max \{\tfrac{\overline{y}}{2} - x_d, 0\} - 2\beta \max \{x_d - \tfrac{\overline{y}}{2}, 0\} \tag{3}$$

and the value of β determines whether dictators divide the surplus in two identical parts (egalitarian allocation) or keep the entire surplus for herself (selfish allocation). It can be shown that the dictator who maximizes equation (3) chooses the egalitarian allocation $\mathbf{x^e} = (\overline{y}/2, \overline{y}/2)$ if $\beta > 0.5$. Otherwise, the dictator behaves selfishly, $\mathbf{x^s} = (\overline{y}, 0)$.[5]

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[4] We acknowledge that it might be hard to disentangle which variables are under the subjects' control and which variables are outside their control in some situations. We find, however, that the classification of factors within and beyond individuals' control is beyond the scope of this paper. For further discussion on this topic, the interested reader can see Fleurbaey and Maniquet [18]. Konow [27] is also an excellent overview of various theories of justice that deals with this feature.

[5] For the special case in which $\beta = 0.5$, the dictator is indifferent between any share $x_d \in [\overline{y}/2, \overline{y}]$. As Fehr and Schmidt [1] argue, the nonlinear versions of their model lead also to predictions $\mathbf{x} = (x_d, x_r)$ that satisfy $x_d \in [\overline{y}/2, \overline{y}]$ and $x_r = \overline{y} - x_d \geq 0$. The models of Bolton and Ockenfelds [28] and Charness and Rabin [29] do

The prediction of Fehr and Schmidt [1] goes in line with the observed behavior in many laboratory experiments, where the equal split is a modal outcome (see Camerer [3] and Engel [4] for a review). The model is especially well-suited when the surplus to be divided as "manna from heaven", because it predicts an allocation that ignores the source of the surplus or its size. However, the underlying idea of Fehr and Schmidt [1] contrasts with fairness ideals that plead for a solution in which entitlements to the available surplus are directly determined by subjects' contributions, an idea that goes back to Selten [30] and it presented in Cherry *et al.* [6], Oxoby and Spraggon [8] or Ruffle [9], among others. The libertarian ethics indeed pursue the idea that subjects ought to receive exactly what they have contributed to surplus (Nozick [31]). The model of Frohlich *et al.* [2] incorporates this idea by adding two terms to the dictator's utility function:

$$u(x_d) = x_d - 2\alpha \max\left\{\frac{\bar{y}}{2} - x_d, 0\right\} - 2\beta \max\left\{x_d - \frac{\bar{y}}{2}, 0\right\} - \gamma \max\{y_d - x_d, 0\} - \psi \max\{x_d - y_d, 0\} \tag{4}$$

The utility function (4) expands upon the previous one so as to include what the authors call "just deserts". Frohlich *et al.* [2] consider that the dictator suffers a cost $\gamma \max\{y_d - x_d, 0\}$ if she does not take her own production, whereas $\psi \max\{x_d - y_d, 0\}$ represents the cost of taking more than what she produces.[6] The new parameters are assumed to satisfy $\gamma \geq \psi > 0$. The authors note that if α and β are both zero, then just deserts affect the dictator's choice when $\gamma > 1$ or $\psi > 1$. If α \$ and β are not zero, two different contexts are at stake: when the dictator accumulates less money than the recipient ($y_d < y_r$), and when the dictator accumulates more ($y_d > y_r$). In either case, when $2\beta + \psi < 1$, the dictator behaves selfishly and keeps the entire surplus, $\mathbf{x^s} = (\bar{y}, 0)$. If the dictator accumulates less money than the recipient and $2\beta + \psi > 1$, the model predicts that the dictator will either keep half of the surplus or her own production, depending on whether $\psi - 1 > 2\alpha$ or $\psi - 1 < 2\alpha$. Both the egalitarian allocation, $\mathbf{x^e} = (\bar{y}/2, \bar{y}/2)$ and the libertarian allocation $\mathbf{x^l} = (y_d, y_r)$ can also be predicted if the dictator accumulates more money than the recipient.

The model of Frohlich *et al.* [2] generalizes the model of Fehr and Schmidt [1] and predicts that recipients might receive any payoff $x_r \leq \max\{\bar{y}/2, y_r\}$. Arguably, the prediction of this model contrasts with liberal egalitarian ethics, which states that subjects should only be rewarded for factors under their control. In that vein, the accountability principle as first proposed by Konow [13] states that the dictator will choose a division that gives to each subject the amount of money that is generated by her input. We denote this amount predicted by the accountability principle as $a_i = \left(\frac{q_i}{q_d + q_r}\right)\bar{y}$ for $i \in \{d,r\}$, so that if the dictator ignores those factors beyond the subjects' control, she will choose the allocation $\mathbf{x^a} = (a_d, a_r)$. We propose to model the dictator's utility function as follows:

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also integrate equality as an argument. In particular, Bolton and Ockenfelds [28] show that the results of Fehr and Schmidt [1] are robust to non-linearity as well as incomplete information.

[6] We note that we have rewritten the original equation in Frohlich *et al.* [2] so as to follow our reasoning in equation (3). In particular, because $y_d + y_r = x_d + x_r$, the latter term in equation (4) can also be thought of as the cost of not giving to the recipient her production.

$$u(x_d) = x_d - 2\alpha \max \{\tfrac{\bar{y}}{2} - x_d, 0\} - 2\beta \max \{x_d - \tfrac{\bar{y}}{2}, 0\} - \gamma \ \max\{y_d - x_d, 0\} -$$

$$\psi \ \max\{x_d - y_d, 0\}\} - \rho \ \max\{a_d - x_d, 0\} - \omega \ \max\{x_d - a_d, 0\} \tag{5}$$

Our specification assumes that the dictator cares about her own monetary payoff, but juggles the tradeoff between subjects' inputs and monetary contributions. This implies that the dictator suffers a cost $\rho \ \max\{a_d - x_d, 0\}$ if she free-rides on the recipient's effort, but she also suffers a cost $\omega \ \max\{x_d - a_d, 0\}$ if she takes less money than what corresponds to her input, where $\rho \geq \omega > 0$ is assumed to be satisfied (*i.e.*, the dictator cares less about the recipient's disadvantage than about her own).

The utility function (5) allows dictators to take into account the way in which inputs are transformed into money so as to "compensate" for those factors outside the subjects' control. Our prediction is that dictators might (i) behave selfishly $\mathbf{x^s} = (\bar{y}, 0)$ (ii) choose the egalitarian allocation and divide the surplus in two identical parts $\mathbf{x^e} = (\bar{y}/2, \bar{y}/2)$, (iii) choose the libertarian allocation that is based on subjects' production $\mathbf{x^l} = (y_d, y_r)$ or (iv) behave according to the accountability principle that is based solely on factors under the subjects' control $\mathbf{x^a} = (a_d, a_r)$.[7] We summarize our results in Table 1. As we argue, the dictator's choice depends on the relationship between factors within and beyond the subjects' control, which determines the relationship between $\bar{y}/2$, y_d and a_d, as well as the values of the parameters.

We derive these results in the supplementary material. Our model predicts that the dictator will behave selfishly, if $2\beta + \psi + \omega < 1$. If it is not the case, the dictator's decision depends on the subjects' inputs ($q_i \geq 0$) as well as on the weight that is assigned to these inputs ($p_i > 0$). Consider that the dictator is at a relative advantage with regard to the accumulation of money ($p_d > p_r$) so that the dictator's production in terms of money y_d would be greater than her production in terms of inputs a_d. The values of $q_i \geq 0$ and $p_i > 0$ determine in this framework whether these contributions (y_d and a_d) are above half of the surplus ($\bar{y}/2$) or not. Assume that $a_d < y_d < \bar{y}/2$ is satisfied. It is clear that the dictator gets the highest monetary payoff by choosing the egalitarian allocation $\mathbf{x^e} = (\bar{y}/2, \bar{y}/2)$. The dictator will choose this division of the surplus as long as the cost of deviating from the accountability principle (that yields the smallest payoff) is small enough. More precisely, $\mathbf{x^e} = (\bar{y}/2, \bar{y}/2)$ will be chosen if $\omega < 1 + 2\alpha - \psi$. If the cost is very high and the condition $\omega > 1 + 2\alpha + \gamma$ holds, the dictator will choose to divide the surplus according to the accountability principle $\mathbf{x^a} = (a_d, a_r)$ that yields the dictator the smallest monetary payoff. If $\omega \in (1 + 2\alpha - \psi, 1 + 2\alpha + \gamma)$, then the libertarian allocation will be chosen because it would be very costly to divide the surplus according to the egalitarian allocation, but the cost is not sufficiently high to enforce the use of the accountability principle. We can follow this reasoning so as to explain the prediction of our model in Table 1. We

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[7] Nonlinear versions of our model would predict interior results that lead to compromises between these fairness ideals. The interested reader can find a brief discussion about the linearity assumption in the supplementary material. We note that Bolton and Ockenfels [28] is an extension of Fehr and Schmidt [1] to the non-linear case. The model of Bolton *et al.* [32] incorporates an idea that is related to the accountability principle in the context of procedural fairness; *i.e.*, the authors use different games and investigate the extent to which subjects care about fair procedures.

observe that there always exists a tradeoff between a higher monetary payoff and the cost of deviating from the fairness ideal that yields the smallest payoff.

Table 1. Predictions of our model.

		Dictators' Allocation Choice		
		$\mathbf{x^e} = (\bar{y}/2, \bar{y}/2)$	$\mathbf{x^l} = (y_d, y_r)$	$\mathbf{x^a} = (a_d, a_r)$
$p_d > p_r$	$a_d < y_d < \bar{y}/2$	$\omega < 1 + 2\alpha - \psi$	$\omega \in (1 + 2\alpha - \psi, 1 + 2\alpha + \gamma)$	$\omega > 1 + 2\alpha + \gamma$
	$a_d < \bar{y}/2 < y_d$	$\omega \in (1 - 2\beta + \gamma, 1 + 2\alpha + \gamma)$	$\omega < 1 - 2\beta + \gamma$	$\omega > 1 + 2\alpha + \gamma$
	$\bar{y}/2 < a_d < y_d$	$2\beta > 1 + \gamma + \rho$	$2\beta < 1 + \gamma - \omega$	$2\beta \in (1 + \gamma - \omega, 1 + \gamma + \rho)$
$p_d < p_r$	$\bar{y}/2 < y_d < a_d$	$2\beta > 1 + \gamma + \rho$	$2\beta \in (1 - \psi + \rho, 1 + \gamma + \rho)$	$2\beta < 1 - \psi + \rho$
	$y_d < a_d < \bar{y}/2$	$\psi < 1 + 2\alpha - \omega$	$\psi > 1 + 2\alpha + \rho$	$\psi \in (1 + 2\alpha - \omega, 1 + 2\alpha + \rho)$
	$y_d < \bar{y}/2 < a_d$	$\psi \in (1 - 2\beta + \rho, 1 + 2\alpha + \rho)$	$\psi > 1 + 2\alpha + \rho$	$\psi < 1 - 2\beta + \rho$

Note. In all the cases above, it is assumed that $2\beta + \psi + \omega > 1$. Otherwise, the dictator behaves selfish, $\mathbf{x^s} = (y, 0)$. We do not consider the possibility of $p_d = p_r$, because (by definition) $a_d = y_d$ in that case our predictions would be identical to the ones in Frohlich *et al.* (2004).

3. Applications of our model

Overall, our model in Section 2 relies on liberal egalitarian ethics, which states that subjects should be only rewarded for factors under their control. The model is especially useful for those cases in which the dictator is at a relative advantage with regard to the accumulation of money ($p_d > p_r$), because in this case our model predicts a larger set of transfers from the part of the dictator than previous models of inequity aversion. In this section, we present a couple of examples so as to illustrate this feature. We also mention at the end of this section some experimental papers that produce behavior that is consistent with our model, and then discuss the relevance of our approach.

To start with, let us consider a numerical example. Imagine that subjects solve a questionnaire during the production stage. In particular, assume that $q_d = 10$ and $q_r = 15$ are the number of correct answers, which are assumed to be controlled by the subjects (*i.e.*, the number of correct answers depends on the exerted effort in the questionnaire). Consider that these questions are rewarded at $p_d = 1.5$ and $p_r = 1$, respectively, where the reward level is exogenously determined and is independent of performance.[8] In that case, the surplus to be distributed is $\bar{y} = 30$ and the subjects' contributions to the surplus is given by $y_d = y_r = 15$. Since both subjects contribute the same (*i.e.*, $y_d = y_r = \bar{y}/2$), the models of Fehr and Schmidt [1] and Frohlich *et al.* [2] predict that the recipient will receive at most half of the surplus. It is worth noting, however, that the dictator might consider this allocation as *unfair* because the recipient has more questions correct at a lower reward level. Liberal egalitarian ethics states that the recipient ought to receive the part of the surplus that is due to her performance, which would compensate recipients for the lower reward. In our example, $a_i = \left(\frac{q_i}{q_d + q_r}\right) \bar{y} = 18$. This amount represents 60-percent of the surplus. Importantly, our model is able to predict this allocation, although this behavior cannot be predicted by equations (3) or (4). In fact, the nonlinear versions of our model

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[8] The experimental design in Rodriguez-Lara and Moreno-Garrido [11] relies on this production stage. In Konow [7], subjects are differently rewarded for a real-effort task that involves stuffing letters into envelops. In Ubeda [24], the task consists of solving puzzles, whereas in Cappelen *et al.* [5], subjects have to choose how much money to invest in an investment game in which the rate of return is exogenously determined.

in the supplementary material can predict any dictator's giving x_r in the interval [15,18], which are above the equal split allocation.

To further illustrate that our model extends upon the previous ones, we consider Figure 1. Along the horizontal axis, we plot the proportion of the surplus that is due to the recipient's production ($y_r/\bar{y}$). We use the vertical axis to represent the proportion of the surplus that the dictator gives away to the recipient ($x_r/\bar{y}$). As a consequence, the 45-degree line represents the appropriate theoretical prediction in Frohlich *et al.* [2], because observations on this line indicate that recipients are being transferred exactly the proportion of the surplus that they have contributed, *i.e.*, the 45-degree line represents the libertarian allocation $x_r = y_r$. In Figure 1, we also plot the horizontal line ($x_r/\bar{y} = 0.5$), which represents the egalitarian allocation $x_r = \bar{y}/2$ (Fehr and Schmid [1]). The dotted curve depicts the accountability principle $x_r = a_r$. Therefore, allocations on this curve indicate that recipients are being transferred exactly the proportion of the surplus that is due to their effort.[9] The difference between p_d and p_r establishes the concavity of the dotted curve $x_r = a_r$ and determines those allocations that cannot be predicted by Fehr and Schmidt [1] or Frohlich *et al.* [2]. In particular, the nonlinear version of these models predicts no allocations above both "just dessert" and the horizontal line $x_r = \bar{y}/2$. Graphically, this implies that the models predict any giving in the shadowed area, except the striped area (*i.e.*, the models predict $x_r \leq \max\{\bar{y}/2, y_r\}$). However, our model takes into account the accountability principle so that our prediction includes the striped area (*i.e.*, our model predict $x_r \leq \max\{\bar{y}/2, y_r, a_r\}$).

Figure 1. Graphical representation of our predictions if $p_d > p_r$.

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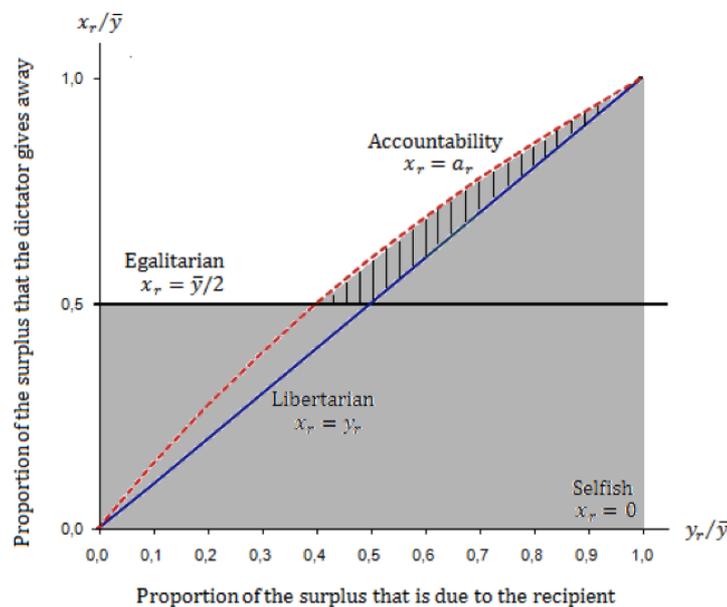
[9] Recall that we focus on the case in which the dictator is rewarded at a higher rate; therefore the recipient's monetary contribution to the surplus will be below her contribution in terms of inputs ($a_r > y_r$). Graphically, this implies that the dotted curve (the accountability principle) is above the 45-degree line (the libertarian principle). Both principles coincide when ($y_r / \bar{y}$) = 0 and ($y_r / \bar{y}$) = 1. In the first case, all the available surplus is due to the dictators' inputs ($q_r = 0$). The contrary is true if ($y_r / \bar{y}$) = 1. We also note that we represent ($y_r / \bar{y}$) on the horizontal line and assume that $p_d = 1.5$ and $p_r = 1$. Thus, the egalitarian principle and the libertarian one coincide when ($y_r / \bar{y}$) = 0.5 (*i.e.*, when $y_r = \bar{y} / 2$), whereas the egalitarian principle and the accountability one coincide if $a_r / \bar{y} = 0.5$ (*i.e.*, when $a_r = \bar{y} / 2$). In order to satisfy this latter condition, both subjects should have exactly the same number of correct answers ($q_d = q_r$), which implies that $y_r / \bar{y} = 0.4$.

All the allocations on the striped area give some weight to the accountability principle, such that these allocations cannot be explained with the models of inequity aversion of Fehr and Schmidt [1] and Frohlich *et al.* [2], in which the idea of liberal egalitarian ethics is disregarded (*i.e.*, $\rho = \omega = 0$ is assumed).

We find that our model generalizes the previous ones and can be used to explain dictators' behavior, especially when the production stage involves factors within and beyond the subject's control. In that context, the accountability principle is likely to lead dictators' behavior, especially when dictators act as a third party in the distributional problem (e.g., Cappelen *et al.* [17] and Konow [7]). The results in Cappelen *et al.* [5], Konow [16] and Rodriguez-Lara and Moreno-Garrido [11] do also produce behavior that is also consistent with the idea of subjects who endorse the accountability principle. In particular, Cappelen *et al.* [5] consider a dictator game with production and estimate that 38 percent of dictators are closest to satisfying the accountability principle, 43 percent to being egalitarians and 18 percent to being libertarians when dividing the surplus. If we use the reported data in Cappelen *et al.* [5] and focus our analysis on the cases in which dictators are at relative advantage with regard to the accumulation of money ($p_d > p_r$), we will find that 15-percent of the dictators behave according to the accountability principle. In Figure 1, these observations would lie on the striped area; therefore these allocation choices cannot be predicted by the previous models of inequity aversion. Similar results can be derived from the reported results in Rodriguez-Lara and Moreno-Garrido [11] or Ubeda [24]. For instance when $p_d > p_r$, roughly 17-percent of the data in Rodriguez-Lara and Moreno-Garrido [11] is incompatible with Fehr and Schmid [1] and Frohlich *et al.* [2], because it includes dictators who transfer $x_r \geq \max\{\bar{y}/2, y_r\}$.[10]

One important feature of our model is that dictators are allowed to weigh three different fairness ideals instead of only one. Graphically, this implies that any allocation on the shadowed area can be derived after considering that dictators weigh the lines $x_r = 0$, $x_r = \bar{y}/2$, $x_r = a_r$ and $x_r = y_r$. This feature of our model generalizes the idea that each dictator is motivated by a single fairness view (*i.e.*, by a single "line"), with dictators being heterogeneous in what they consider as fair, and the marginal utility loss of deviating from this fairness ideal increasing in the size of the deviation. Our way of modeling social preference is also valid under the assumptions that fairness ideals are tradeoffs against each other, and heterogeneity lies inside each subject rather, than taking place across subjects. It remains to be discussed whether we should expect subjects to hold different fairness ideals at each time. Using a questionnaire, the seminal paper of Yaari [25] provides evidence that subjects choose different solutions for the same distribution problems, depending on the prevalence of tastes or needs in the story underlying each question (see also Messick and Sentis [23]). Recent experimental findings are also in line with the idea of within-subject heterogeneity (e.g., Croson and Konow [22], Konow [16], Ubeda [24], Blanco *et al.* [33] and Miller and Ubeda [10]). In their paper, Blanco *et al.* (2011) test the consistency of the Fehr and Schmidt's model and find that it fails to predict behavior at the individual level, as subjects exhibit different fairness attitudes across games (*i.e.*, the estimation of and α and β for a given subject changes depending on the game). The work of Miller and Ubeda [10] focuses on a

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[10] We note that our model cannot be tested using the reported data in other experiments such as Bolton and Ockenfels [28], Charness and Rabin [29] or Fehr and Schmidt [1], which do not consider a production stage.

repeated dictator game with production and highlight that women are likely to switch between the three different fairness ideals presented in the current paper.

4. Conclusion

We have presented a theoretical model of social preferences that expands upon Fehr and Schmidt [1] and Frohlich *et al.* [2]. The underlying idea of our model is that dictators who are involved in a dictator game with production care about three different features. First, dictators get disutility if the final allocation deviates from the equal division. Second, dictators consider that subjects should receive exactly what they have produced. Finally, dictators account for the way in which entitlements are generated and try to compensate for factors beyond subjects' control.

Our contribution to the literature is to provide a model that predicts the accountability principle in Konow [13], which states that subjects should only be rewarded for factors under their control. This behavior is in accordance with liberal egalitarian ethics and cannot be predicted by the models of inequity aversion of Fehr and Schmidt [1] and Frohlich *et al.* [2], although it is observed in many laboratory experiments.

One novelty of our approach with respect to Cappelen *et al.* [5], Cappelen *et al.* [15] or Konow [7] is that we do not need to assume that, "individuals have a fairness ideal that is independent of the distributional function in which they find themselves [Cappelen *et al.* 2007, page 824]." Our model is suitable for this case of between-subjects heterogeneity, but it does also accommodate for the possibility of heterogeneity of fairness ideals lying inside each individual.

Acknowledgments

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